

## **Saving Lives: Teaching Vital Signs Assessment to Radiography Students**

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**Abstract:** Early recognition of possible medical emergencies leads to quick intervention, potentially saving lives. Radiographers (x-ray techs) are often the only healthcare professionals present during an imaging exam and must be able to accurately assess vital signs readings in order to determine the need for medical response. The only radiography program in Hawaii had no formal method for teaching this important skill; therefore, an online vital signs assessment module was created to address this issue. The successful implementation of the *Saving Lives: Learning Vital Signs Assessment* website lead to the conversion of the module into a complete course hosted by the NEO learning management system (LMS). John Keller's ARCS Model of Motivational Design was used as the theoretical foundation for the new *Saving Lives* course, since literature reviewed supported application of this framework for online instruction. Attention and relevance were gained through presentation of medical scenarios. Confidence and satisfaction were boosted by the immediate feedback that the NEO LMS provided. The *Saving Lives* course was evaluated early in the Spring semester, using one-on-one interviews conducted with a content matter expert and a website design expert. Suggested changes to the module were made, and small group implementation was conducted. Thirteen first-year radiography students worked independently on the instructional module for one week. Results demonstrated an overall improvement between pre- and post-test scores and positive reception of the online instructional module. This study supports the effectiveness of e-learning in the healthcare field when teaching practical skills such as vital signs assessment.

### **Introduction**

Radiographers, more commonly known as x-ray techs, are healthcare professionals who specialize in the area of diagnostic imaging. All radiographers in the state of Hawaii are required to go through training in a formal education program and pass the national

certification examination administered by the American Registry of Radiologic Technologists (ARRT). The ARRT Certification Handbook (2013) states that one of the content specifications that radiography students must learn while in their program is patient care.

Learning proper vital signs assessment is an important part of administering effective patient care. The radiographer is usually the only healthcare professional present during the examination of a patient. The safety and well-being of that patient depends on the ability of the technologist to recognize the need for a medical response. Accurately assessing deterioration in a patient's condition will prompt early intervention and may help to prevent a life-threatening emergency (Ehrlich & Coakes, 2013).

There is currently no formal method for teaching this skill within the only radiography program in the state. In previous years, the students reviewed pertinent chapters in their patient care textbook on their own, then participated in a laboratory session where they practiced their skills. This method proved ineffective for certain students, as they experienced a difficult time assimilating the knowledge from the textbook without instruction or feedback of any kind. It took these students longer to achieve proficiency in taking vital signs readings, and their skill level in vital signs assessment was not measured at all.

In an effort to remedy this situation, an online module for teaching vital signs assessment was created during the ETEC 613 Instructional Design and Development course in the Spring semester of 2014. The results of the initial *Saving Lives: Learning Vital Signs Assessment* module implementation were promising, with students displaying improvement between pre- and post-test scores and responding positively when surveyed on this new means of instruction. However, there were certain weaknesses inherent in utilizing an open website as a platform for an educational module. As a result, the existing module was revised and improved to address these issues and better suit the students' needs.

It is the responsibility of Hawaii's only radiologic technology program to ensure that all students receive an exemplary education in the content specified by the ARRT. Educational technology can serve to bridge this gap, as it is widely being used to prepare students for the healthcare industry, and can help students who have grown up using technology to stay "engaged and focused" in the topic at hand (Bristol & Kyarsgaard, 2012). The purpose of this instructional design project was to improve and evaluate an online interactive module for teaching vital signs assessment to first-year radiography students at a community college in Honolulu, Hawaii.

### **Literature Review**

The ability to perform basic vital signs assessment is an essential skill for radiographers, who have the responsibility to intervene when potential emergency situations arise. The radiographer is often the initial observer of any changes in the patient's condition, and should be trained to recognize signs of deterioration (Ehrlich & Coakes, 2013).

Radiography students should be taught basic assessment skills such as using the proper equipment to obtain vital signs, appropriately interpreting those readings, documenting other physical signs and symptoms, and analyzing that data (ARRT, 2013). These critical thinking skills should be imparted to students while they are still in a safe and controlled learning environment, to prevent exposing patients to the potential risk of adverse effects due to their inexperience (Lewis, Strachan, & Smith, 2012).

The accurate interpretation of vital signs is of particular importance. Occasionally, changes in body position can affect vital signs such as heart rate or blood pressure and may be mistaken for illness (Emergency Nurses Association, 2011). Students in healthcare should learn to correctly assess a situation so that an appropriate response can be performed, as physical deterioration often precedes dangerous or potentially fatal events such as a heart attack (Liaw, Scherpbier, Klainin-Yobas, & Rethans, 2011). In a study done by the Wake University School of Medicine on the predictive value of abnormal vital signs for risk of death, researchers found that the presence of three "critically abnormal" vital signs was associated with a patient mortality rate of 23.6% (Bleyer, Vidya, Russell, Jones, Sujata, Daeihagh, & Hire, 2011). Disturbances in multiple vital signs are common in patients with severe illness, as they may exhibit either extremely high or very low respiratory rates, body temperatures, pulse rates, or blood pressures. Early detection of these disturbances can lead to a faster response and improve the outcome for these patients with acute illness (Royal College of Physicians, 2012).

As teaching important skills such as vital signs assessment can be a challenge for instructors in medical fields, the incorporation of educational technology into traditional instruction is one solution that can help prepare students for their entry into the healthcare industry (Bristol & Kyarsgaard, 2012). Millennial learners expect e-learning as part of their education, and are progressively utilizing more technology as educational tools (Bahner, Adkins, Patel, Donley, Nagel, & Kman, 2012). E-learning is an effective way to manage potentially limited resources in education, allowing for students to move at their own pace and self-identify areas which require further study (Thomson, Campbell, & O'Leary, 2011). Multimedia items such as video demonstrations or animations can present complex concepts in a more efficient manner by replacing or supplementing text with visual representations in motion, enhancing engagement and relevance to the learner (Yue, Kim, Ogawa, Stark, & Kim, 2013).

Utilization of an online format for teaching health assessment has proven to be successful. In a study conducted at the Boston University School of Medicine, online modules were used to teach delirium assessment to fourth-year medical students. Those students who used the online modules performed better than their counterparts in correctly identifying the problem and coming up with appropriate treatments (Chao, Brett, Wiecha, Norton, & Levine 2012). Online modules in pharmacy practice skills, including vital signs assessment, were also implemented by the University of Missouri-Kansas City School of Pharmacy. This two year study included 190 students, and revealed significant improvement between pre- and post-test scores for students. 85% of students were able to apply what they learned in the patient care setting (Ruehter, Lindsey, Graham, & Garavalia, 2012).

Designing instruction in an online format requires specific issues to be kept in mind, as there are new aspects of teaching and learning involved in these environments (Hess & Gunter, 2013). In order to effectively teach with technology, educators must align the content to be taught with an appropriate method of teaching and determine the best technology with which to accomplish that aim (Voogt, Fisser, Pareja-Roblin, Tondeur, & van Braak, 2012). According to Mayer's cognitive theory of multimedia learning, it is also important to keep in mind that learners have limited cognitive capacity in their visual and pictorial information processing channels; therefore, an effort should be made to prevent overloading them during learning. Too much extraneous cognitive processing can overload the channels, so irrelevant information or distracting images and sounds should be avoided (Mayer, 2010). Learners should be allowed to progress at their own pace so as not to overwhelm their essential cognitive processing, and complex subject matter such as that found in the medical field should be delivered in smaller chunks (Mayer, 2010; Kulasekara, Javatilleke, & Coomaraswamy, 2011).

Allowing students to learn at their own pace promotes intrinsic motivation towards learning and encourages problem solving and active application of knowledge (Fang & Strobel, 2011). Independent problem solving skills can also be developed through providing students with challenging scenarios, teaching them how to adapt to new situations in order to effectively deal with a continuously changing environment such as the healthcare setting (Valijataga & Laanpere, 2010). Incorporating self-assessment questions into the module can provide valuable and immediate feedback to students (Kulasekara et al., 2011). When designing online modules, it is important to consider e-learning visual design principles as well. An unattractive look or feel can detract from the content and deter users from continuing onward (Foster, Shurtz, & Pepper, 2014).

### **Project Design**

The initial *Saving Lives* learning module was constructed in Weebly, and assessments were created by embedding Google Forms within the website. The Weebly website builder allowed for beautiful page design, and was easy to work with. Unfortunately, it was lacking in specific features necessary to make for an effective educational tool. As the website was open and available to anyone who had the link, there was a potential for outsiders who were not enrolled in the course to fill out the Google Forms and contaminate the assessment data. Students had the ability to move through the various sections in random order, and navigation through the site was somewhat confusing. Also, students could not review their responses for the embedded practice exams once the Google Forms were submitted, so the information on the feedback pages was not as relevant or helpful as it should have been.

When considering improvements to resolve these issues, the principal investigator decided to retain an online format for the instructional module, as the literature strongly supports online methods of learning for this generation of college students (Bahner et al., 2012). The literature reviewed also indicated that this student population prefers their information to be delivered in smaller portions (Kulasekara et al., 2011), so the original content of the module remained organized into the same concise sections when moved into the new platform. The educational content of the revised module was based on the following instructional goals.

### **Instructional Goals**

The first instructional goal for the module was to instruct radiologic technology students on how to correctly perform vital signs assessments. Students were given the appropriate techniques for obtaining vital sign measurements, as well as information on how to assess those measurements. Relevant images, including those of the proper equipment for taking vital signs, were placed in the appropriate sections of the module to complement the text (Mayer, 2010).

The second instructional focus for this module was to teach students the normal and abnormal ranges for the four vital signs of body temperature, pulse rate, respiration rate, and blood pressure. The sections were reorganized in a different order from the original module, sequencing the content from the easiest concepts to the more complex (Dick, Carey, and Carey, 2009). Embedded tests could be accessed multiple times in order to serve as self-assessments for students to obtain immediate and valuable feedback on their progress (Kulasekara et al., 2011).

The final and most crucial instructional goal was to instruct students on how to apply their knowledge and problem-solving skills to correctly evaluate various medical scenarios. This module provided complex scenarios during which a patient's vital signs measurements and other pertinent information were revealed. These challenging scenarios were designed to promote the development of adaptation and independent problem solving skills in the healthcare setting (Valijataga & Laanpere, 2010).

### **Platform**

As the original module was constructed in a Weebly website, various educational components such as testing and grading were not inherent in the system. It was determined that a learning management system (LMS) would be the best choice for constructing an instructional module for use in a formal educational program. The LMS platform selected for this instructional module was NEO, formerly known as EDU 2.0.

Information on the NEO LMS can be accessed at <https://www.neolms.com>. NEO is a secure system, so students need to be either enrolled by the instructor or given an access code in order to view the module and take the assessments. This addressed the security vulnerability inherent in openly accessible website builders such as Weebly. The user interface, although not customizable to the extent of Weebly, was much more user-friendly and visually appealing than other learning management systems such as Lulima or Canvas (Appendix A). Visual items such as tables, images, emoticons and even video could be embedded directly into the lesson page (Appendix B). Maintaining aesthetic appeal was important, so as not to detract from the content or deter users from utilizing the module (Foster, Shurtz, & Pepper, 2014).

NEO also allowed for setting up “gateways” so that students could not progress to the next section until they had completed and mastered the previous one. This remedied the problem of having an instructional module set up in a website where students could freely navigate to any page they wish to. The embedded tests served as “gatekeepers,” as they were set to only allow progression to the next section after a specific benchmark had been attained by the student (Appendix C). Students needed to demonstrate understanding of the easier concepts first, before being allowed to move on to the more complex or unfamiliar ones (Dick et al, 2009).

The assessments within NEO were also fully customizable, with options to include images and personalize the feedback students received when reviewing their exam results (Appendix D). After completing the embedded tests, students could view their responses to the questions and compare them to the correct answers via this feedback section. This

increased the relevancy of the practice exams and allowed the students self-assess their proficiency or any areas of weakness (Thomson, Campbell, & O’Leary, 2011).

### **Framework**

This project was based on John Keller’s ARCS Model of Motivational Design (Keller & Deimann, 2012). This theoretical framework was chosen because it best fit instructional design in an online format. The learner’s attention was gained via perceptual arousal through the use of different information presentation methods such as images and text. Attention was also gained through inquiry arousal by posing various scenarios that the student were required to correctly evaluate (Appendix E).

The relevance of the material being learned was reinforced in the introduction to the module (Appendix F). Awareness of the present and future value of the skills that they will be learning leads to intrinsic motivation to learn this required material. Clear learning objectives at the top of each lesson page ensured that students understood the performance requirements and evaluation criteria used to measure their success in learning the skills presented (Appendix B). As each section of the module was completed, the feedback received from their performance on the embedded tests served to boost the learner’s confidence (Appendix D).

This immediate feedback provided also served to address the satisfaction component of the ARCS model. Students can take pride in improving their performance in a skill that most of them are not familiar with. This factor of satisfaction will also be reinforced when students are given the opportunity to practice their new vital signs assessment skills in the laboratory setting later in the semester.

## **Methods**

### **Research Questions**

This project was driven by two major research questions. The first was to determine if the content presented was appropriate and sufficient for achieving the instructional goals of this module. The second was to determine if the methods of information delivery and instruction were effective for this specific student population. It was anticipated that small group testing with the target group of radiography students would reveal a significant increase in their post-test scores as compared to their pre-test scores after completion of the instructional module.

### Participants: One-on-One Interviews

A content matter expert and a website design expert were asked to review the instructional module. The content matter expert was a professor in the radiography department of a local community college who had been in the field for over 30 years. This content matter expert had reviewed the previous iteration of this project, and was a great asset in maintaining the continuity of the formative assessment. The website design expert was an advertising consultant who specialized in digital media art.

### Participants: Small Group Testing

The small group testing subjects for this study were 13 first-year students enrolled in a radiography program at a community college in Honolulu, Hawaii. These students ranged in age from 19 to 43 years of age, with an average class age of 26. There were 7 females and 6 males, so each gender was fairly evenly represented. The ethnicity of the students was predominantly Asian, with three Caucasian students. Previous medical experience for these students varied from five months to one year, with the majority of their experience coming from having spent the previous fall semester as a student in the radiography program. Most of the participants stated that they have previous experience with online courses, and the majority were very comfortable with using technology. (See Figure 1.) This corresponds with the information provided by the literature review, which points to online learning as an appropriate means of instruction for students in the “Millennials” generation (Bahner et al., 2012).

Age	Gender	Ethnicity	Patient Care Experience (in months)	Previous Experience with Online Courses?	How Comfortable Are You with Using Technology?
19	F	Asian	5	Yes	Very
20	F	Asian	7	No	Somewhat
21	M	Asian	6	Yes	Very
21	F	Asian	6	Yes	Very
22	F	Asian	5	Yes	Very
23	M	Asian	6	Yes	Very
24	F	Asian	9	Yes	Somewhat
25	F	Asian	7	Yes	Very
28	M	Asian	6	Yes	Very
28	M	Caucasian	6	Yes	Very
32	M	Asian	8	Yes	Very
33	F	Caucasian	6	Yes	Very
43	M	Caucasian	12	Yes	Very

Figure 1. Small group participant demographics.



## Procedures

To increase the efficiency of this instructional design module, extensive formative testing was performed to identify potential issues as early as possible (Roytek, 2010). One-on-one feedback sessions with a content matter expert and a website design expert were conducted in the beginning of the study. A two-hour interview with the content matter expert involved working through each section of the module while sitting together at the same computer, reviewing the content portions line by line. A one-hour interview was conducted with the website design expert in the same manner, with a focus on the aesthetics of the module. Notes taken during both of these sessions were compiled and analyzed for possible points of improvement (Dick et al, 2009). Identified necessary revisions to the module were completed prior to small group implementation.

The first-year Radiologic Technology program students were contacted as a group during the first week of Spring Semester. In the recruitment email sent to them (Appendix G), the purpose of the study was explained, the benefits and risks discussed, and contact information provided should they require more clarification on any points of the project. Consent to participate in the study was implied upon completion of the module. The link to the demographic survey (Appendix H) was emailed to all participants prior to small group implementation. This survey was administered via Google Forms and contained questions regarding age, gender, ethnicity, patient care experience, previous experience with online courses, and comfort level with using technology. The results of that survey are seen in Figure 1 above.

Small group testing commenced after revisions to the module were completed. Study participants were enrolled in the NEO LMS by the primary investigator and emailed a link to the online module. The students were given a week to work through the online module independently. The small group testing participants worked through a pre-test at the beginning of the module to assess their prior level of knowledge regarding vital signs assessment. Each section of the module contained embedded tests, which the students could repeatedly take as practice exams to solidify their retention and comprehension. Finally, the students took a post-test to assess their knowledge acquisition. (See Appendix E for examples of the pre-test, embedded test, and post-test questions.)

After the students had completed the instructional module, the link to a post-course attitudinal survey was emailed to all participants to evaluate their perception of the instructional module (Appendix I). This survey was administered via Google Forms and contained questions which assessed their views on the adequacy of the content, the effectiveness of the method of delivery, and the quality of the practice exercises and feedback. The survey utilized a five-point Likert scale with a continuum from “Strongly

Agree” to “Strongly Disagree”. Two open-ended questions at the end also allowed for specific feedback regarding any areas of improvement to the content or aesthetics of the module.

### Results

Data was collected from the NEO LMS following small group testing. Individual scores from the pre-tests and post-tests were first grouped by test item number and divided by the total number of participants to obtain the percentage of correct responses per test item (Dick et al, 2009). Each test item corresponds to a specific learning objective for the chapter (Appendix E). Figure 2 below displays student performance by test item for Unit 1 - Body Temperature, Unit 2 - Pulse Rate, Unit 3 – Respiration Rate, Unit 4 – Blood Pressure, and Unit 5 – Vital Signs Assessment.

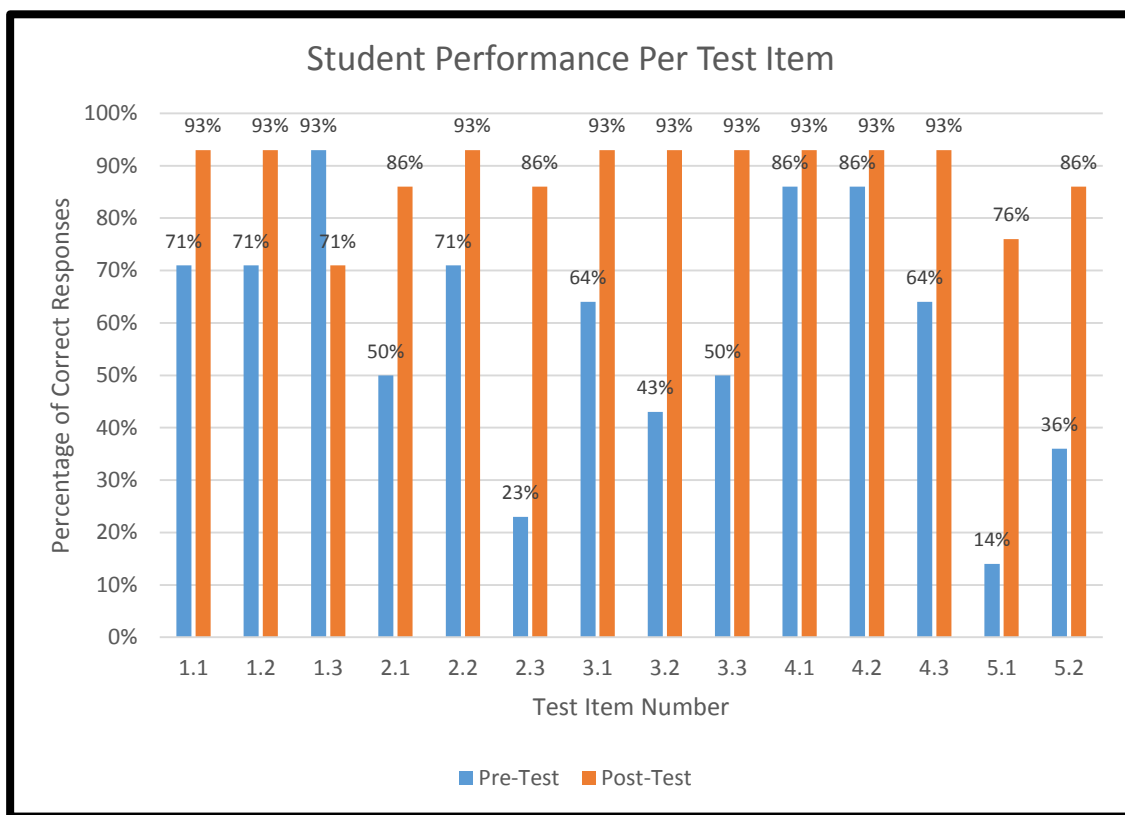


Figure 2. Student performance by test item for Units 1-5.

Test item 1.1 tested knowledge of normal body temperature range, and displayed an increase in percentage of correct responses from 71% in the pre-test to 93% in the post-test. Test item 1.2 tested knowledge of abnormal body temperature range, and also displayed an increase in percentage of correct responses by the test subjects from 71% in the pre-test to 93% in the post-test. Test item 1.3 posed a brief scenario for knowledge

application regarding normal versus abnormal body temperature range. This item demonstrated an unexpected decrease in percentage of correct responses, from 93% in the pre-test to 71% in the post-test. These results, as well as other data gathered for this study, will be further examined in the Discussion section.

Test item 2.1 assessed knowledge of normal pulse rate range, and displayed a large increase in percentage of correct responses from 50% in the pre-test to 86% in the post-test. Test item 2.2 tested knowledge of abnormal pulse rate range, and displayed a smaller increase in percentage of correct responses from 71% in the pre-test to 93% in the post-test. Test item 2.3 posed another brief scenario for knowledge application regarding normal versus abnormal pulse rate range. This test item demonstrated a drastic increase in the percentage of correct responses, from 23% in the pre-test to 86% in the post-test.

Test item 3.1 gauged knowledge of normal respiration rate range, and demonstrated an increase in percentage of correct responses from 64% in the pre-test to 93% in the post-test. Test item 3.2 tested knowledge of abnormal respiration rate range, and showed a large increase in percentage of correct responses from 43% in the pre-test to 93% in the post-test. Test item 3.3 posed a scenario to test the participant's ability to apply their new knowledge when evaluating normal versus abnormal respiration rate range. This test item demonstrated another large increase in performance, from 50% correct responses in the pre-test to 93% correct responses in the post-test.

Test item 4.1 tested knowledge of normal blood pressure range, and demonstrated a small increase in percentage of correct responses from 86% in the pre-test to 93% in the post-test. Test item 4.2 tested knowledge of abnormal blood pressure range, and demonstrated another small increase in percentage of correct responses from 86% in the pre-test to 93% in the post-test. Test item 4.3 evaluated knowledge application ability with a scenario regarding normal versus abnormal blood pressure range. This test item displayed an increase in percentage of correct responses, from 64% in the pre-test to 93% in the post-test.

Unit 5 was the most difficult section, as this was where the students needed to take the knowledge they had learned throughout the module and apply it to complicated medical scenarios. Test items 5.1 and 5.2 posed different medical scenarios. Students were given background information regarding the situation, then given the readings for the four vital signs. The participants needed to assess the readings and overall situation to determine if the given scenario constituted a medical emergency. Both test items displayed a drastic improvement in performance; with a very large increase in percentage of correct responses from 14% in the pre-test to 76% in the post-test for item 5.1, and another large

increase in percentage of correct responses from 36% in the pre-test to 86% in the post-test for item 5.2.

The test results were also analyzed by objective, to examine overall student mastery of each subject. Answering all items in a unit correctly was the criterion for mastery (Dick et al, 2009). The results can be seen in Figure 3 below.

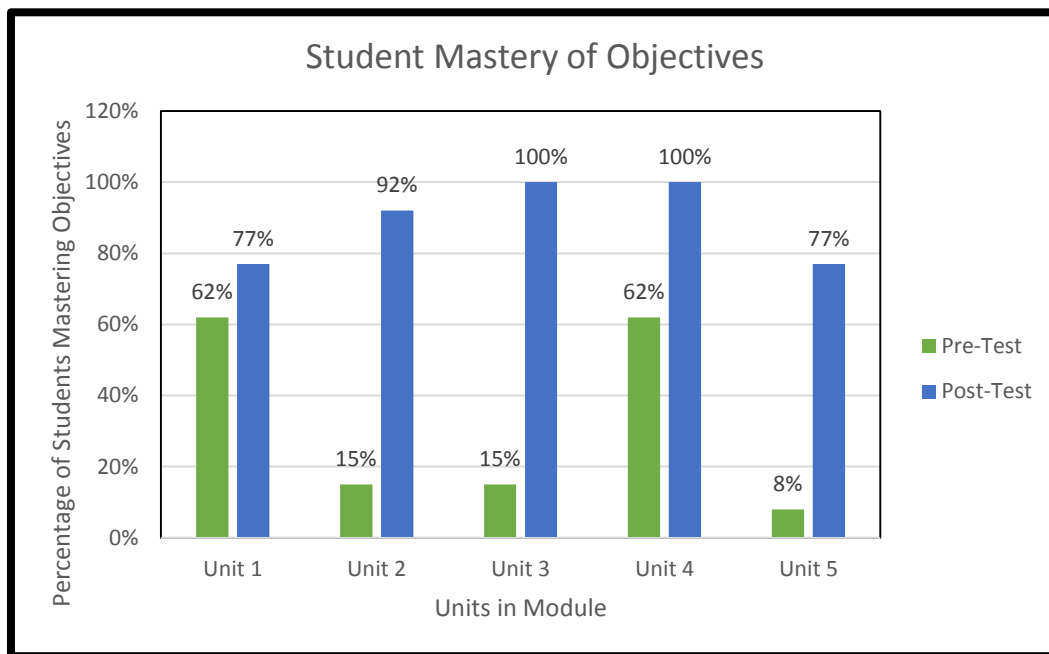


Figure 3. Student mastery of objectives.

Unit 1 displayed a small increase in the number of students mastering the concept of body temperature ranges, from 62% in the pre-test to 77% in the post-test. Unit 2 demonstrated a drastic increase in the percentage of students mastering the less familiar vital sign of pulse rate, from 15% in the pre-test to 92% in the post-test. Unit 3 showed the largest improvement in the percentage of students mastering the concept of respiration rate after completion of the module, from 15% in the pre-test to 100% in the post-test. Unit 4 displayed another smaller increase in the number of students mastering the concept of blood pressure ranges, from 62% in the pre-test to 100% in the post-test. Finally, Unit 5 illustrated another great improvement in the percentage of students mastering the difficult concept of overall vital signs assessment, with an increase from 8% in the pre-test to 77% in the post-test.

The results from the post-course attitudinal survey were also compiled and analyzed. Figure 4 displays the results of the first eight questions which employed a five-point Likert scale to assess the participants' opinions on the module.

Attitudinal Survey Responses (n = 10)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The instruction was presented in an interesting manner.	70%	30%			
2. I understood the concepts that were taught in this module.	80%	20%			
3. The information presented helped me to achieve the stated objectives.	50%	40%	10%		
4. There were a sufficient number of practice exercises included in the module.	50%	50%			
5. The practice exercises given were relevant to the material being presented.	70%	30%			
6. I received sufficient feedback on my practice exercises.	60%	10%	30%		
7. The tests adequately measured my knowledge of the concepts learned.	40%	60%			
8. I felt confident in my ability to answer the questions in the tests.	40%	50%	10%		

Figure 4. Results from the post-course attitudinal survey.

The majority of the students (70%) surveyed strongly agreed that the instruction was presented in an interesting manner, and 80% strongly agreed that they were able to understand the concepts that were taught in the module. Only 50% strongly agreed that the information presented was adequate for achieving the learning objectives, with 10% giving a neutral response. (For the purposes of this study, a neutral response was considered a negative response.) Only half of the participants surveyed strongly agreed that there were a sufficient number of practice exercises, but 70% of them strongly agreed that the exercises provided were relevant and helpful.

Also regarding the practice exercises, 60% of students strongly agreed that they received sufficient feedback, with 30% providing a neutral response. Only 40% strongly agreed that the tests given adequately assessed their knowledge. Regarding confidence, only 40% strongly agreed that they felt confident in their ability to perform well on the tests, with 10% giving a neutral response.

The open ended questions were compiled into a WordCloud, to illustrate the most common thoughts and ideas presented within the comments received. The results can be seen in Figure 5. Overall, it appeared that the participants felt that the material in the module was “well presented”, “easily understood”, and “works nicely”. Other comments received were that the module was “well described”, “nicely designed” and “awesome”.



*Figure 5.* Responses to open-ended questions in post-course attitudinal survey.

### **Discussion and Conclusions**

Overall, the results showed improvements across nearly every objective between pre-test and post-test performance. Improvement of student mastery for every subject were also seen. The post-course survey results demonstrated an all-around positive reception of the vital signs assessment module by the participants. The little patient care experience which the small group test subjects had does not seem to have negatively impacted their ability to retain and comprehend the information presented in the vital signs assessment module. Their prior knowledge may have actually been a benefit to them, allowing them to easily grasp complex concepts and apply them to the scenarios presented.

The one exception where post-test performance actually dropped was for test item 1.3, seen in Figure 2. This decrease in the percentage of correct responses between the pre-test (93%) and post-test (71%) was unexpected. One possibility is that the wording of the post-test question may have been unclear or confusing in some way. All test items will be examined to determine if there are any which need to be revised for clarification.

The unusually high pre-test scores seen in test items 1.1, 1.2, 1.3 and 2.2 (Figure 2) could possibly have resulted from the aforementioned prior patient care experience of the participants. This trend of high pre-test scores can also be seen in Figure 2 for test items 3.1, 4.1, 4.2, and 4.3. This may be an unavoidable result, as this module will continue to be implemented in the Spring semester, after the target audience has already been exposed to one semester of training. The unusually high number of students demonstrating mastery of Units 1 and 4 based on pre-test scores in Figure 3 could also be explained by prior knowledge of the participants. Unit 1 covers body temperature range, which is the most common vital sign known to people outside of healthcare. Unit 4 covers blood pressure ranges, something which most people are also aware of due to the increasing availability of health-related information. Even if the small group participants were students who were not in a health-related field, they may have been able to perform just as well on the pre-test assessments for these two subjects.

The post-course attitudinal survey results revealed more possible areas of improvement. Although post-test results supported the adequacy of the course content, the participants felt that they could have used more information or perhaps have the information presented in a different way. The content of the module will be expanded and video or other multimedia aspects added to address the varying learning styles of students who will be using this module in the future. The results also showed a desire for more practice exercises and feedback on their performance throughout the module. More exercises will be developed, with a possibility of turning these practice activities into a game which will be embedded into the module. The pre-test and post-test assessments will be reviewed for level of difficulty and relevance as well, as the input received regarding test questions points to a possible need for revision.

Assessing all results in terms of the research questions, it appears that the content provided was sufficient for achieving the instructional goals for the module and was appropriately presented in smaller portions. It also appears that the online method of delivery and instruction was effective for this particular student population. This second iteration of the vital signs assessment learning module was well received by the intended target audience, and appears to have fulfilled its intended purpose.

In conclusion, accurate vital signs assessment is an important aspect of patient care which all healthcare professionals should become proficient at. The *Saving Lives: Learning Vital Signs Assessment* module appears to be an effective means of delivering instruction for this necessary skill to first-year radiography students. The analysis of the results from this second evaluation of the instructional module have provided insight into potential areas of improvement. Appropriate modifications to the instructional module will be made in the near future, as this online course will become a permanent part of the curriculum of the radiography program at the community college.

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



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**APPENDIX A**  
**Example of User Interface – NEO LMS**

 Saving Lives: Learning Vital Signs Assessment






-  Admin
-  Welcome
-  Lessons
-  Assignments
-  Gradebook
-  Students
-  Teachers



### Lessons



 Delete



☐ Lesson



☐  Complete Pre-Test First  
This assessment must be completed before entering the lessons in this module.



☐  Lesson 1: Body Temperature   
A description of the lesson goes here.

☐  Lesson 2: Pulse Rate   
A description of the lesson goes here.

☐  Lesson 3: Respiration Rate   
A description of the lesson goes here.


☐  Lesson 4: Blood Pressure   
A description of the lesson goes here.

☐  Lesson 5: Vital Signs Assessment   
A description of the lesson goes here.

☐  Complete Required Post-Test   
This final assessment must be completed in order to receive full credit for this course.

## APPENDIX B

### Lesson Pages



- Welcome
- Lessons
- Complete Pre-Test First
- Lesson 1: Body Temperature
  - Student Objectives
  - Identifying Normal Body Temperature Range
  - Identifying Abnormal Body Temperature Range
  - Determining Normal vs. Abnormal Body Temperature Range
  - Test Your Knowledge!
- Lesson 2: Pulse Rate
- Lesson 3: Respiration Rate
- Lesson 4: Blood Pressure
- Lesson 5: Vital Signs Assessment
- Complete Required Post-Test
- Assignments

### Saving Lives: Learning Vital Signs Assessment

#### Lesson 1: Body Temperature

Index

- Student Objectives
- Identifying Normal Body Temperature Range
- Identifying Abnormal Body Temperature Range
- Determining Normal vs. Abnormal Body Temperature Range
- Test Your Knowledge!


#### Student Objectives

- Given four temperature readings, you will identify the reading that falls into the normal temperature range without error.
- Given four temperature readings, you will identify the reading that falls into abnormal temperature range without error.
- Given a scenario in the healthcare setting, you will identify whether the temperature reading obtained falls into the normal or abnormal range without error.

#### Identifying Normal Body Temperature Range

Body temperature is a measure of the body's ability to regulate the amount of heat generated and released. Temperature is measured using a thermometer on various locations of the body. The forehead, mouth, ear, armpit and rectum are the most commonly used places. For this module, all stated body temperature readings refer to those taken by mouth (orally). The unit of measurement used in expressing body temperature is either degrees Fahrenheit (°F) or degrees Celsius (°C) depending on location; the United States primarily measures in degrees Fahrenheit.

Normal body temperature can range from 97.8 °F and 99.1 °F in a healthy adult, sometimes varying an entire degree over the course of the day. The long-standing convention of a "normal" body temperature reading of 98.6 °F is actually an average of the daily fluctuations. People's "normal" temperature can go past this range, with no ill effects appearing until temperatures drop below 95 °F or rise above 103 °F. Factors which can affect body temperature include gender, food and fluid levels, emotions, heavy clothing, weather, time of day (highest in the evening), activity level, and hormone levels.



**EXAMPLE**

Don woke up not feeling very well. Several of his coworkers have been out sick this week with flu symptoms including fever. He uses a thermometer and checks his temperature orally. It says his temperature is 97.9 °F, which falls within the normal range of 97.8 to 99.1 °F.



### Saving Lives: Learning Vital Signs Assessment

#### Lesson 1: Body Temperature

#### Identifying Abnormal Body Temperature Range

Body temperatures can range an entire degree higher or lower than normal during the course of a day. When temperature readings drop more than one degree below normal, this is known as hypothermia. When temperature readings rise more than one degree above normal, this may indicate pyrexia (commonly known as fever) or the even more serious hyperthermia (sometimes called heat stroke). Abnormal body temperature readings occur when the mechanisms for releasing or conserving heat do not work properly. Children and the elderly are particularly susceptible to abnormal body temperatures.

Hypothermia refers to the condition of having a body temperature below 97.8 °F. This condition becomes dangerous and may be life-threatening once body temperature drops below 95 °F. Hypothermia occurs when more heat is lost than the body can generate. The body tries to fight heat loss by constricting blood vessels and moving blood further in to surround the organs in the core. The body also starts shivering, involuntary muscle contractions which help generate more heat. When these measures do not work, hypothermia sets in.



Some potential causes of hypothermia include:

- cold exposure
- age (being either very old or very young)
- being chronically ill or having an infection
- being under the influence of alcohol or drugs

Pyrexia, or fever, refers to the condition of having a body temperature above 100.4 °F. Fever is a temporary increase in the body's temperature in response to illness, as most viruses and bacteria cannot survive higher than normal temperatures. Hyperthermia is an abnormally high body temperature caused by failure of the body to deal with heat in the environment. Heat stroke is a life-threatening form of hyperthermia that occurs when body temperatures rise above 103 °F, and is accompanied by serious symptoms. The elderly are especially at risk during the hot summer months.

Some potential causes of pyrexia are:

- infections by viruses or bacteria
- immunizations
- autoimmune or inflammatory disorders like arthritis or lupus
- certain medications





Some potential causes of hyperthermia are:

- impaired blood circulation or reduced ability to sweat (caused by old age or medications)
- being dehydrated
- certain medications
- being very overweight or underweight



☰

Saving Lives: Learning Vital Signs Assessment

 Kimberly Suwa

Lesson 1: Body Temperature

Determining Normal vs. Abnormal Body Temperature Range

In a healthy adult, body temperature readings usually fall between 97.8 °F and 99.1 °F. Variations in body temperature can occur throughout the day, and potentially rise or fall up to one degree around the established average body temperature of 98.6 °F. Symptoms usually begin to occur when body temperatures move drastically past the normal variation. Abnormal body temperatures occur when the body cannot regulate the amount of its internal heat in extremely cold or extremely hot environmental conditions.

Hypothermia - serious symptoms appear when body temperature drops below 95 °F.

➡ Symptoms:

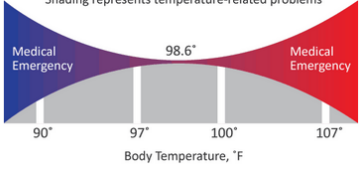
- drowsiness
- weakness and loss of coordination
- pale and cold skin
- uncontrollable shivering
- slowed breathing or heart rate

Pyrexia/Hyperthermia - serious symptoms may appear when body temperature rises above 103 °F.

➡ Symptoms:

- headache
- dizziness or lightheadedness
- confusion or combativeness
- rapid, weak pulse or rapid, shallow breathing
- dry, hot, red skin

Shading represents temperature-related problems




EXAMPLE


Paul's checkup at his doctor's office includes an oral temperature reading. He has not been experiencing any unusual symptoms. The nurse tells him that he has a temperature of 98.8 °F, which is within the normal range of 97.8 and 99.1 °F.

Great job! 🎉 Now continue on to ➡

Test Your Knowledge!

 Congratulations, you have passed this gateway assignment.







Click on "See Assignment" below.

 See assignment

## APPENDIX C

### Embedded Test

Saving Lives: Learning Vital Signs Assessment

     Kimberly Suwa 

Test Your Knowledge!

1 2 3 ✓

[< Previous](#) [Next >](#) [Pause](#) [Pop up instructions](#)

Question 3

☰ Multiple choice (one answer) · Points: 1

Andrew is recovering from surgery in the hospital. His nurse notices that he looks a little pale and checks on him. His pulse rate, respiration rate, and blood pressure are all within normal range. His body temperature is 98.9 °F. This temperature is

Select one:

☐ a little high; but falls within normal range

☐ abnormally high; indicating pyrexia or hyperthermia

☐ abnormally low; indicating hypothermia







☐ a little low; but falls within normal range

Submit


## APPENDIX D

### Test Feedback

Saving Lives: Learning Vital Signs Assessment

 Kimberly Suwa 


Lesson 1: Body Temperature



Answers


Here are your latest answers: Your best submission is [here](#)

Question 1


 Which of the following oral temperature readings falls within the normal range?

Response: [none]

Correct answer: 98 °F


Score: 0 out of 1 

Question 2


 Which of the following oral temperature readings falls within the abnormal range?

Response: [none]

Correct answer: 103.4 °F


Score: 0 out of 1 

Question 3

 Andrew is recovering from surgery in the hospital. His nurse notices that he looks a little pale and checks on him. His pulse rate, respiration rate, and blood pressure are all within normal range. His body temperature is 98.9 °F. This temperature is

Response: [none]

Correct answer: a little high; but falls within normal range

Score: 0 out of 1 

**APPENDIX E**  
**Instruments within Module**

**Pre- and Embedded Test Questions**

Match the following terms with their correct definition

EL1: Blood pressure	A. The number of times the heart beats per minute
EL2: Pulse rate	B. The level of heat produced and sustained by the body
EL3: Respiration rate	C. The force of blood pushing against artery walls
EL4: Body temperature	D. The number of breaths a person takes per minute

1. Which of the following blood pressure readings falls into the normal range?
  - a. 80/50 mmHg
  - b. 120/80 mmHg
  - c. 160/100 mmHg
  - d. 180/110 mmHg
2. Which of the following blood pressure readings falls into the abnormal range?
  - a. 80/50 mmHg
  - b. 100/70 mmHg
  - c. 110/80 mmHg
  - d. 120/80 mmHg
3. Martha checks into the emergency room because she feels lightheaded. Her temperature, pulse rate, and respiration rate are all a little high, but still within normal range. Her blood pressure reading is 112/75 mmHg. This blood pressure reading is
  - a. a little high; but falls within normal range.
  - b. abnormally high; indicating hypertension
  - c. abnormally low; indicating hypotension
  - d. a little low; but falls within normal range
4. Which of the following pulse rates falls into the normal range for an adult at rest?
  - a. 30 bpm



- b. 50 bpm
  - c. 70 bpm
  - d. 110 bpm
5. Which of the following pulse rates falls into the abnormal range for an adult at rest?
- a. 70 bpm
  - b. 80 bpm
  - c. 100 bpm
  - d. 110 bpm
6. Mark walks into an after-hours clinic because he feels like he can't breathe. His temperature, respiration rate, and blood pressure are all within normal range. His pulse rate is at 98 beats per minute. This pulse rate is
- a. a little high; but falls within normal range.
  - b. abnormally high; indicating tachycardia
  - c. abnormally low; indicating bradycardia
  - d. a little low; but falls within normal range
7. Which of the following respiration rates falls into the normal range for an adult at rest?
- a. 5 bpm
  - b. 10 bpm
  - c. 20 bpm
  - d. 30 bpm
8. Which of the following respiration rates falls into the abnormal range for an adult at rest?
- a. 11 bpm
  - b. 15 bpm
  - c. 18 bpm
  - d. 20 bpm
9. Calvin collapses, and is brought into the emergency department via ambulance. The ER nurse checking his vital signs finds that his temperature, pulse rate, and blood pressure are all within normal ranges. His respiration rate is 12 breaths per minute. This respiration rate is
- a. a little high; but falls within normal range.
  - b. abnormally high; indicating tachypnea
  - c. abnormally low; indicating bradypnea
  - d. a little low; but falls within normal range
10. Which of the following oral temperature readings falls into the normal range?
- a. 95 °F

- b. 98 °F
- c. 100 °F
- d. 104 °F

11. Which of the following oral temperature readings falls into the abnormal range?

- a. 97.8 °F
- b. 98.6 °F
- c. 99.1 °F
- d. 103.4 °F

12. Andrew is recovering from surgery in the hospital. His nurse notices that he looks a little pale and checks on him. His pulse rate, respiration rate, and blood pressure are all within normal range. His body temperature is 98.9 °F. This temperature is

- a. a little high; but falls within normal range.
- b. abnormally high; indicating pyrexia or hyperthermia
- c. abnormally low; indicating hypothermia
- d. a little low; but falls within normal range

13. Scenarios

- a. Elaine is a teacher who is on her daily run when she trips over a tree root and twists her ankle. Her doctor refers her to your hospital to get an x-ray of her ankle to assess the injury. She is in a lot of pain and her ankle looks swollen. When checking her into your imaging department, you get the following vital signs readings:

Blood pressure: 132/85 mmHg

Pulse rate: 60 beats per min

Respiration rate: 14 breaths per min

Temperature: 98.6 °F

Identify any abnormal readings (there may be more than one) and explain whether the abnormal reading(s) indicate a possible medical emergency.

- b. Fred is a construction worker who suffers from a headache and pain in his neck for days. His doctor sends him to your clinic for an x-ray of his neck to look for possible injury. While there, he starts to complain of nausea and tells you that the lights are too bright. You get him to sit down in a darkened room and obtain the following vital signs readings:

Blood pressure: 124/82 mmHg

Pulse rate: 70 beats per min

Respiration rate: 18 breaths per min

Temperature: 103.5 °F

Identify any abnormal readings (there may be more than one) and explain whether the abnormal reading(s) indicate a possible medical emergency.

### Post-Test Questions

1. Identify the blood pressure reading that falls into the normal blood pressure range.
  - a. 86/55 mmHg
  - b. 117/76 mmHg
  - c. 142/94 mmHg
  - d. 150/110 mmHg
2. Identify the blood pressure reading that falls into the abnormal blood pressure range.
  - a. 85/55 mmHg
  - b. 99/65 mmHg
  - c. 111/72 mmHg
  - d. 120/78 mmHg
3. Terry makes an appointment with his doctor because his headaches seem to be getting worse. When he checks in at the office, his temperature, pulse rate, and respiration rate are all within normal ranges. His blood pressure reading is 142/95 mmHg. This blood pressure reading is
  - a. a little high; but falls within normal range.
  - b. abnormally high; indicating hypertension
  - c. abnormally low; indicating hypotension
  - d. a little low; but falls within normal range
4. Identify the pulse rate that falls into the normal pulse rate range for an adult at rest.
  - a. 55 bpm
  - b. 87 bpm
  - c. 108 bpm
  - d. 121 bpm
5. Identify the pulse rate that falls into the abnormal pulse rate range for an adult at rest.
  - a. 69 bpm
  - b. 70 bpm
  - c. 92 bpm
  - d. 115 bpm

6. Sheila is a patient in the critical care unit of the hospital. The nurse checking her vital signs finds that her temperature, respiration rate, and blood pressure are all within normal ranges. Her pulse rate is at 40 beats per minute. This pulse rate is
  - a. a little high; but falls within normal range.
  - b. abnormally high; indicating tachycardia
  - c. abnormally low; indicating bradycardia
  - d. a little low; but falls within normal range
7. Identify the respiration rate that falls into the normal respiration rate range for an adult at rest.
  - a. 9 bpm
  - b. 18 bpm
  - c. 26 bpm
  - d. 52 bpm
8. Identify the respiration rate that falls into the abnormal respiration rate range for an adult at rest.
  - a. 10 bpm
  - b. 12 bpm
  - c. 15 bpm
  - d. 20 bpm
9. Cherie has been sick for a while and finally decides to go see the doctor for her cough. Upon checking in, her temperature, pulse rate, and blood pressure are all found to be within normal range. Her respiration rate is 25 breaths per minute. This respiration rate is
  - a. a little high; but falls within normal range.
  - b. abnormally high; indicating tachypnea
  - c. abnormally low; indicating bradypnea
  - d. a little low; but falls within normal range
10. Identify the oral temperature reading that falls into the normal temperature range.
  - a. 83.5 °F
  - b. 96.8 °F
  - c. 98.6 °F
  - d. 100.2 °F
11. Identify the oral temperature reading that falls into the abnormal temperature range.
  - a. 97.7 °F
  - b. 98.6 °F
  - c. 99.5 °F
  - d. 101.1 °F

12. Lynn is feeling confused and clumsy after walking in the snow for an hour. She wanders into a clinic, where a nurse finds that her pulse rate, respiration rate, and blood pressure are all within normal ranges. Her body temperature is 96.2 °F. This temperature is
- a little high; but falls within normal range.
  - abnormally high; indicating pyrexia or hyperthermia
  - abnormally low; indicating hypothermia
  - a little low; but falls within normal range

13. Scenarios

- George is the CEO of a large company who has been experiencing tightness in his chest and difficulty breathing. His doctor refers him to your hospital for an x-ray of his chest to look for signs of illness. When checking him into the imaging department, you get the following vital signs readings:

Blood pressure: 120/80 mmHg

Pulse rate: 80 beats per min

Respiration rate: 20 breaths per min

Temperature: 99.0 °F

Identify any abnormal readings (there may be more than one) and explain whether the abnormal reading(s) indicate a possible medical emergency.

- Betty is a housewife who accidentally cuts her hand with a knife while chopping vegetables. Her doctor writes orders for her to get an x-ray of her hand to assess the extent of damage from the injury. She is feeling anxious and lightheaded. When you check her in, you get the following vital signs readings:

Blood pressure: 85/50 mmHg

Pulse rate: 110 beats per min




Respiration rate: 12 breaths per min


Temperature: 97.8 °F




Identify any abnormal readings (there may be more than one) and explain whether the abnormal reading(s) indicate a possible medical emergency.

## APPENDIX F

### Introduction to Module

 Saving Lives: Learning Vital Signs Assessment  



 Welcome  
 Lessons  
 Assignments

### Introduction

**Welcome future radiologic technologists!**

Every radiologic technologist in the state of Hawaii is required to be nationally registered before they can practice out in the field. The American Registry of Radiologic Technologists (ARRT) certification examination will test you on the knowledge that you obtain while in this academic program. As future technologists, one of the areas you will be responsible for is basic patient care.

One of the components of basic patient care is correctly assessing the **four vital signs of blood pressure, pulse rate, respiration rate, and body temperature**. As a radiologic technologist, you are often the only medical professional in the x-ray room, and therefore are responsible for the safety and well-being of the patient in your care. Vital signs collected upon checking into the imaging department or clinic can provide important information about a patient's state of health.

This module has been designed to instruct you on how to correctly perform vital signs assessments to identify possible medical emergencies. If you determine that the patient is experiencing an emergency medical condition, the imaging examination should not be conducted and appropriate measures must be taken. By presenting you with various scenarios throughout the module, you will be able to put your knowledge and problem solving skills into practice within the safe environment of the classroom.

Overview of Module Content:

Cluster Title	Learning Time
Chapter 1: Body Temperature	10 min
Chapter 2: Pulse Rate	10 min
Chapter 3: Respiration Rate	10 min
Chapter 4: Blood Pressure	15 min
Chapter 5: Vital Signs Assessment	15 min

**Learn vital signs assessment, and learn to save a life!**

The material that you will be learning is designed to complement the practical lab at the end of the semester where you will learn how to take vital signs measurements. As you successfully complete each section, the next one will unlock and open for you. Complete all lessons, as well as the pre-test and post-test, to receive full credit for this vital signs assessment module.

Let's get started! Click on the "Lessons" option on the menu to the left.

## **APPENDIX G**

### **Recruitment Email**

Aloha First Years,

I'm doing a research project as part of the requirement for earning my Master's degree. The purpose of this project is to improve and evaluate an online interactive module for teaching vital signs assessment to first-year radiography students. I am inviting you to participate because you are a first year student in the Radiologic Technology (Rad Tech) program here at the college.

- *What will I have to do?*

Participation in this project will involve independently working through an online learning module on a website which I have created. You will have one week to work through the module at your own pace. You can start and stop working on the module at any time, but please be sure to complete all sections of the course.

- *What is this online learning module about?*

This module is designed to teach you how to appropriately assess vital signs. You will learn what the normal and abnormal ranges are for the four vital signs of blood pressure, pulse rate, respiration rate, and body temperature. You will then be presented with scenarios which you will evaluate in order to determine if the situation is a medical emergency.

- *How will this help me?*

Participation in this study provides an easy means for fulfilling one of the American Registry of Radiologic Technologists (ARRT) educational requirements. The ARRT requires that all radiography students learn vital signs assessment. Completion of this module will provide verification that you have demonstrated competency in this specific patient care activity. There is no risk to you associated with participation in this project.

- *Other considerations:*

Participation in this project is completely voluntary. Any personal information collected during this project will be kept confidential. Any data collected will not be reported with your name or other personal identifiers. Findings will be reported in a way that protects your privacy and confidentiality to the extent allowed by law. Completion of the entire module will be considered as your implied consent for participation in this study.

Your participation in this research project would be greatly appreciated. Your feedback will be used to improve the online vital signs learning module for future Rad Tech students. Your participation will also help you to fulfill your ARRT educational requirement.

**I will be sending you a link to the online module on Monday, February 2, 2015. Please watch for a message from NEO LMS in order to gain access to the vital signs instructional module.**

Contact Information: For any questions regarding the project, please feel free to contact myself (contact information listed below) or my University of Hawaii faculty advisor, Dr. Catherine Fulford at [\(808\) 956-3906](tel:8089563906). For any questions regarding your rights as a research participant, please contact the UH Manoa Office of Research Compliance Human Studies Program at [\(808\) 956-5007](tel:8089565007).

Mahalo,

Kimberly Suwa, B.A., R.T.(R)  
Program Director  
Radiologic Technology Program  
Kapiolani Community College



## APPENDIX H

### Demographic Survey

### Demographics Survey

Please fill out the survey below. We are only collecting general demographic information for the purposes of improving our instructional module. All information will be kept confidential and will not be released to any outside party.

**\* Required**

**Age? \***

**Gender? \***

**What is the ethnicity that you most identify with? \***

**What is your current level in the Rad Tech program? \***  
(First Year or Second Year)


**What is your current amount of patient care experience? \***  
(In Months or Years)

**Do you have previous experience with taking online courses? \***  
(Yes or No)

**How comfortable are you with using technology such as laptops, tablets or smartphones? \***  
(Very, Somewhat, Not Comfortable)

Never submit passwords through Google Forms.

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## APPENDIX I

### Attitudinal Survey

#### "Learning Vital Signs Assessment" Post-Course Survey

Please fill out the following survey regarding the "Saving Lives: Learning Vital Signs Assessment" module that you reviewed today.

**\* Required**

**1. The instruction was presented in an interesting manner. \***

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

**2. I understood the concepts that were taught in this module. \***

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

**3. The information presented helped me to achieve the stated objectives. \***

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

**4. There were a sufficient number of practice exercises included in the module. \***

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

**5. The practice exercises given were relevant to the material being presented. \***

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

6. I received sufficient feedback on my practice exercises. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

7. The tests adequately measured my knowledge of the concepts learned. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

8. I felt confident in my ability to answer the questions in the tests. \*

1 2 3 4 5

Strongly Disagree ☐ ☐ ☐ ☐ ☐ Strongly Agree

Any additional comments or suggestions regarding the content or material presented in the website? \*

Any additional comments or suggestions regarding the aesthetics or functionality of the website? \*

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